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Barriers to the Dissemination of Research Findings of Decision Modeling in the Management of Cardiovascular Disease

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The discussion and general conclusions of a working group convened during the Regenstrief Conference are presented. The group was formed to consider issues involved in the dissemination of research findings relative to decision modeling in the management of cardiovascular disease.

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The problem facing most researchers at some point in the progress of their research is whether their efforts will be of use in the nonresearch clinical community. The denouement for the researcher occurs when the results of his or her time, effort and energy yield knowledge and skills that are both valid and useful. An appropriate question for the researcher to ask repeatedly is: Where on the road of usefulness are we with respect to this particular research? Although this pragmatic approach may be eschewed by the basic researcher whose only (main) purpose is the production of new knowledge, those concerned with clinical decision making need to deal directly with its applicability because of its very nature. With this in mind, the planners of the 1987 Regenstrief Conference on Quality and Cost-Conscious Cardiovascular Care: Role of Decision Modeling asked a working group to convene and consider the issues involved in the dissemination of research findings relating to decision modeling in the management of cardiovascular disease.

Methods

Eleven conference participants (John Feussner, MD, Margaret Holmes, PhD, Edward Huth, MD, Itzhak Jacoby, MD, Stephen Jay, MD, Charles Kelly, MD, Keith Marton, MD, William McGivney, PhD, John Peirce, MD, Richard Powell, MD and Colleen Sears) gathered for 2½ h during which time they had a general discussion and went through a modified nominal group process (1) to identify the barriers to dissemination of the research findings. The concept of barriers comes from the work of Kurt Lewin (2) and his force-field analysis as a way to identify those areas where effort should be focused in progressing toward a desired goal. Seven major barriers were identified that the group felt warranted discussion and elaboration. The elaboration of the barriers came in part from the group's discussion and in part from my own research and experience. Because I am a director of medical education in a major community teaching hospital of a medical school, I will approach the topic from the perspective of practicing physicians who have little or no significant research knowledge or skill and no background in decision modeling.

Results

The major barriers to the dissemination of research findings in the use of decision modeling in the management of cardiovascular disease were identified. These are: 1) a limited perceived need and clinical utility for decision modeling in clinical practice, 2) present limitations of the "product," 3) the "foreign language" employed by those of us in medical decision making, 4) the lack of financial incentives for physicians to use decision modeling, 5) a lack of collaboration and cooperation between researchers and potential users of decision modeling, 6) a perceived threat to the autonomy of physicians, and 7) the present medicolegal climate. Each of these will be discussed in greater detail.

A limited perceived need and clinical utility for decision modeling in clinical practice. The benchmark for decision support in clinical medicine is the consultation. With a good consultation, clarity emerges from confusion and insights previously hidden become apparent. The diagnosis (or diagnoses), pathophysiology and treatment (or treatments) are clarified, and appropriate care is undertaken where previously this had been in doubt. The practicing physician is faced with three major stressors in practice: the press of time, clinical situations where the course of action is highly

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uncertain and management of a patient for whom the potential consequence are serious and catastrophic and whose outcome depends on the skill of the physician. Physicians find useful methods and procedures that save time, reduce uncertainty and increase the probability of a favorable outcome, especially when the potential consequences threaten life, longevity or useful functioning. Pauker (3) has argued that the "role of the decision model is not to provide an answer but to understand the problem." In this context, it serves the same function as a complete history and physical examination. It is a disciplined approach from which insights are derived by going through the process. The practicing physician has to judge when a complete history and physical examination are likely to yield important information and are worth the time and effort to pursue them (that is, determine when they are indicated). Unfortunately, although decision analysis possesses internal construct validity, external validation is lacking (4). Despite its extensive use in many clinical settings, the question of whether decision modeling provides a clinically significant advantage to the clinician over intuitive decision making has yet to be answered.

Part of the difficulty is due to a lack of a generally accepted and understood construct of where computerized decision modeling fits in the process of clinical decision making. Blois (5) addressed this in an elegant fashion. Early in the encounter with a patient, the physician has to scan a tremendous amount of information and determine what is relevant. The decisions made come from the physician's knowledge of life and disease. Once the problem has become well structured and the type of information that needs to be dealt with has been clearly identified and delimited, computerized decision modeling can be useful. The determination of what is relevant is the essence of clinical judgment and something that the well trained human mind does very well and the computer does very poorly. Conversely, recall of large amounts of information with subsequent manipulation and calculation is something done very well by computers and very poorly by even the best trained human minds. Defining those situations and circumstances where mathematical decision modeling will have an impact is an important research goal.

Present limitations of the product. As models are important, so by their very nature they have limitations.

> Models are a way of constructing reality, ways of imposing meaning on the chaos of the phenomenal world. This is not to deny the independent reality of that world but to emphasize that it does not present itself to us organized in the ways we have come to view it. The models physicians use have decisive effects on medical behaviour. The models determine what kind of data will be gathered; phenomena become "data" precisely because of their relevance to a particular set of questions (out of a possible set of questions) which is being asked. Once in place, models act to generate their own verification by excluding phenomena outside the frame of reference the user employs. Models are indispensable but hazardous because they can be mistaken for reality itself rather than as but one way of organizing that reality (6).

The models currently being used appear too complex on the one hand and too simple on the other. They are too complex because most physicians have not mastered the skills of constructing decision trees, inserting probabilities and utility functions, running sensitivity analyses and using microcomputers, most likely because they are not convinced that these are necessary usable skills. Decision models are too simple because, as with any model or abstraction, information is lost, information that the clinician thinks may be relevant.

The "foreign language" employed in medical decision making. The concepts and principles that make up decision modeling are foreign to most practicing physicians, and there is no contextual overlap with other parts of the physicians' knowledge base other than the elements of the case itself. Those of us who are intrigued with the entire area of mathematical modeling and decision supports have learned a new language with which our colleagues are generally unfamiliar. This helps us maintain a nice, small unique culture, but it also puts distance between us and our colleagues when we use it. Of one thing we can be sure, however. If and when decision modeling proves to be an effective and powerful decision tool, many will rush to learn the new language and the skills of decision modeling. In the meantime, in the service of attracting more people to use and experiment with it and as part of proving its efficacy, we should promote its being taught in medical schools and residencies and in making the language more "user-friendly."

The lack of financial incentives for physicians to use decision modeling. The recent studies of Hsaio et al. (7) show that "evaluation and management" are at the low end of the scale of reimbursement using the methodology of the resource-based relative value study. The fear is that the methodology of decision making would be valued less than the methods of invasive and noninvasive imaging, laboratory tests, operative surgery and the like. Clearly, if the policies of payers of health care continue as they have, the efficacy of decision modeling will need to be demonstrated before it is given a unique reimbursement code apart from the usual initial or follow-up evaluations. Nonetheless, if there is redress in the inequitable reimbursement policies regarding evaluation and management, this may stimulate greater effort in the development of decision support systems.

A lack of cooperation and collaboration between researchers and potential users of decision modeling. This is an age-old problem in applied research. Researchers are generally not good at marketing their research, which is generally left to the entrepreneurs. Yet, this is one of the areas where productive research could well be done. The speed of

diffusion of highly effective and efficient technology can be rapid, as evidenced by endoscopy and computed tomographic scanning. The breakthroughs afforded by computerized enhancement were stunning. The critical element there was that data elements were displayed in visually understandable forms that the practicing physicians' trained mind grasped quickly. The barriers between the researchers and the practitioners were dissolved by making the information "user-friendly"(that is, putting it in a context that was readily grasped by the clinician). In the case of endoscopy, the development of fiber optics allowed great ease of scanning large areas with a much higher degree of safety and comfort. Researchers have not yet begun to explore with the practicing physician which decision models would be useful and how the information should be displayed so that it is readily understood and usable.

A perceived threat to the autonomy of physicians. As Blois (5) stated:

> It would be unfortunate, therefore, if physicians were to mistakenly regard their professional cognitive skills as lying in just those steps of the diagnostic processes which are, or may become, computational in nature, and thereby minimizing their indispensable role in dealing with situations in general.

The fear stems from not understanding the strengths and limitations of both the human mind and computerized decision modeling and their complementarity. Computerized decision models allow for analysis when there is a large amount of *relevant information* to be analyzed. Judgment about structuring the problem, what information to use and when to use decision modeling will still reside with the physician. Having the knowledge and skills to perform decision modeling is quite another matter. For those who possess such knowledge and skills and, thus, use them as a way to extend their own decision making capabilities rather than "give the right answer," their autonomy will be enhanced.

The present medicolegal climate. The fear of litigation is pervasive and diffuse. Those who see decision modeling used in an authoritative way to provide "the answer" could see it being used by the legal profession in ways that threaten physicians. More importantly, ignorance of decision modeling in a climate in which attorneys will use anything they can to gain the advantage is unsettling. Nonetheless, we need to proceed with courage to determine how it can help us, rather than let a diffuse nonspecific fear stall us.

Discussion

Current status of decision modeling. Sox (8) described the stages of the diffusion of knowledge as: 1) nascent: theoretical and early experimental; 2) experimental/investigative; 3) new to practice; 4) in established use; and 5) outmoded. Clearly, decision modeling is beyond the first stage. Publication of the journal *Medical Decision Making* since 1983 and the cataloging of the uses of decision analysis in different clinical settings by Kassirer et al. (4) are evidence of the extensive experimental work going on in decision modeling. Despite its widespread experimental use in many clinical settings, recent reviews (4,9) of decision analysis have concluded that it has found little acceptance in day to day practice. This would place decision modeling at the second stage. Its efficacy still needs to be determined and elaborated.

Future developments. As it becomes clearer to physicians that decision modeling can complement their own clinical decision-making skills, they will need to learn the indications for its use. A critical step will be for the physician to develop the capability to structure problems in such a way as to make using decision models effective. This will require new knowledge and skills. Computerized decision modeling, in and of itself, requires special training to be applied in an effective and efficient manner. Whether this requirement will cause the emergence of a new subspecialty or whether it will be integrated into the skills of all the specialties and subspecialties remains to be seen. The capability of decision modeling to bring clarity out of confusion and to effectively address the concerns of practicing physicians in a timely manner will determine its ultimate usefulness.

References

1. Delbecq AL, VandeVen AH, Gustafson DH. Group Techniques for Program Planning: A Guide to Nominal Group and Delphi Processes. Glenview, IL: Scott, Foresman, 1975.
2. Lewin K. Field Theory in Social Science. London: Tavistock Publications, 1952.
3. Pauker S. Cardiovascular decision modeling methodology for clinical applications. Presented at the 1987 Regenstrief Conference on Quality and Cost-Conscious Cardiovascular Care: Role of Decision Modeling. McCormick's Creek State Park, Indiana, October 5, 1987.
4. Kassirer JP, Moskowitz AJ, Lau J, Pauker SG. Decision analysis: a progress report. Ann Intern Med 1987;106:275–91.
5. Blois MS. Information and Medicine. The Nature of Medical Descriptions. Berkeley: University of California Press, 1984:158–68.
6. Eisenberg L. Disease and illness. Cult Med Soc 1977;1:9–23.
7. Hsaio WC, Braun P, Becker ER, Dinicola M, Ketcham TR. Results and policy implications of the resource-based relative-value study. N Engl J Med 1988;319:275–89.
8. Sox HC. The diffusion of technology. Presentation at the Ninth Annual Symposium of the Society of Medical Decision Making. Philadelphia, Pennsylvania, October 1987.
9. Pauker SG, Kassirer JP. Decision analysis. N Engl J Med 1987;316:250–8.